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Radiative Forcing over Ocean by Ship Wakes

Charles K. Gatebe (1); E. Wilcox (3); R. Poudyal (4); J. Wang (5)

¹*Goddard Earth Sciences Technology and Research, Universities Space Research Association, Columbia, 10211 Wincopin Circle, Suite 500, Maryland 21044-3432, USA*

²*NASA Goddard Space Flight Center, Greenbelt, Maryland 20771, USA*

³*Desert Research Institute, Reno, Nevada 89512, USA*

⁴*Science Systems and Applications, Inc., Lanham, Maryland 20706, USA*

⁵*University of Nebraska-Lincoln, 303 Bessey Hall Lincoln, Nebraska 68588-0340, USA*

Correspondence: charles.k.gatebe@nasa.gov

Changes in surface albedo represent one of the main forcing agents that can counteract, to some extent, the positive forcing from increasing greenhouse gas concentrations. Here, we report on enhanced ocean reflectance from ship wakes over the Pacific Ocean near the California coast, where we determined, based on airborne radiation measurements that ship wakes can increase reflected sunlight by more than 100%. We assessed the importance of this increase to climate forcing, where we estimated the global radiative forcing of ship wakes to be $-0.00014 \pm 53\% \text{ Wm}^{-2}$ assuming a global distribution of 32331 ships of size ≥ 100000 gross tonnage. The forcing is smaller than the forcing of aircraft contrails (-0.007 to $+0.02 \text{ Wm}^{-2}$), but considering that the global shipping fleet has rapidly grown in the last five decades and this trend is likely to continue because of the need of more inter-continental transportation as a result of economic globalization, we argue that the radiative forcing of wakes is expected to be increasingly important especially in harbors and coastal regions.